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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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| Applicant's or agent's file reference 6446 | FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416) | |
| International application No. PCT/JP01/08535 | International filing date (day/month/year) 28 September 2001 (28.09.01) | Priority date (day/month/year) 29 March 2001 (29.03.01) |
| International Patent Classification (IPC) or national classification and IPC H01L 29/80, 21/338 | | |
| Applicant NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY | | |

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|----|---|
| 1. | This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36. |
| 2. | This REPORT consists of a total of <u>4</u> sheets, including this cover sheet. <input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of _____ sheets. |
| 3. | This report contains indications relating to the following items: I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application |

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| Date of submission of the demand 20 March 2002 (20.03.02) | Date of completion of this report 10 December 2002 (10.12.2002) |
| Name and mailing address of the IPEA/JP Facsimile No. | Authorized officer Telephone No. |

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/JP01/08535

I. Basis of the report

1. With regard to the elements of the international application:*

- ☒ the international application as originally filed
- ☐ the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the claims:
pages _____, as originally filed
pages _____, as amended (together with any statement under Article 19
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the drawings:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheets/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|-----|-----|
| Novelty (N) | Claims | | YES |
| | Claims | 1-3 | NO |
| Inventive step (IS) | Claims | | YES |
| | Claims | 1-3 | NO |
| Industrial applicability (IA) | Claims | 1-3 | YES |
| | Claims | | NO |

2. Citations and explanations

Claims 1-3

Document 1: Technical Research Report of The Institute of Electronics, Information and Communication Engineers, CPM2000-108 to -116, 20 October, 2000 (20.10.00), Vol. 100, No. 372, pages 19-24, particularly page 20, left column, line 1 to right column, line 18, page 21, Figs. 1 and 2 (a) and (b), page 23, left column, line 1 to right column, final line, Figs. 7 (a) and (b)

describes a negative resistance field effect element, comprising (1) an InAlAs or AlGaAs barrier layer having a trench with (111) A face as one lateral face and (331) B face as the other lateral face opposite to each other because it is formed on an InP or GaAs substrate having an asymmetric V groove with (100) face as one lateral face and (011) face as the other lateral face, (2) an InGaAs or GaAs quantum wire (a) grown on the bottom of the said trench of the said barrier layer and (b) having a relatively narrow energy band gap as a high mobility channel, and (3) an InAlAs or AlGaAs spacer layer (a) grown on the said quantum wire, (b) having a relatively wide energy band gap as a low mobility channel, (c) having a delta doped layer for partially lowering conduction band energy, and (d) constituting a modulation doped layer, wherein they electrically conduct with the said high mobility channel through a contact layer.

Furthermore, the document describes a lamination structure consisting of an n-type InAlAs layer, n-type InGaAs layer, n-type InAlAs layer and n-type InAs layer on a channel.

Document 1 does not describe to the effect that the field effect element has (1) a source electrode and (2) a drain electrode spaced from each other in the length direction of a quantum wire, and (3) a gate electrode (a) provided between the said source electrode and the said drain electrode and (b) facing the said low mobility channel through an insulation layer or a Schottky junction. However, it is considered to be obvious to a person skilled in the art, that a field effect element has these electrodes.

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of : V.2.

Claim 1

Document 2: Applied Physics Letters, 1 January, 2001 (01.01.01), Vol. 78, No. 1, pages 76-78, full text describes (1) an InAlAs or AlGaAs barrier layer having a trench with (111) A face as one lateral face and (331) B face as the other lateral face opposite to each other because it is formed on an InP or GaAs substrate having an asymmetric V groove with (100) face as one lateral face and (011) face as the other lateral face, (2) an InGaAs or GaAs quantum wire (a) grown on the bottom of the said trench of the said barrier layer and (b) having a relatively narrow energy band gap, and (3) a quantum wire having an In AlAs or AlGaAs spacer layer (a) grown on the said quantum wire and (b) having a relatively wide energy band gap.

Document 3: Japanese Journal of Applied Physics, November 2000, Vol. 39, Part 1, No. 11, pages 6152-6156, particularly page 6152, right column, line 26 to page 6153, right column, line 9 describes that quantum wires are used for forming an FET.

It is considered to be obvious for a person skilled in the art, to use the quantum wires described in document 2 for forming the FET described in document 3.